NASA Earth Science Communications: Airplane to TDRSS

Completed Technology Project (2013 - 2014)

Project Introduction

The main objective of this proposal is to perform a feasibility study for the use of NASA's Tracking and Data Relay Satellite System (TDRSS) as the provider of communication services for NASA aircrafts. The feasibility study will lead us to the end goal of defining an airplane communication system architecture through TDRSS. The driver of this effort is to reduce costs of airborne missions and improve communication's reliability. The NASA Airborne Science Program is an important part of the Earth Sciences Division within the Science Mission Directorate that provides "aircraft systems that further science and advance the use of satellite data"1. It includes aircraft, e.g. the Wallops P3, and Dryden ER-2 and Global Hawk, with instruments that continue to advance the science achieved from these platforms, used by investigators from NASA, other government agencies and universities. Goddard Space Flight Center (GSFC) has a successful history of airborne scientific instruments, for example the ER-2 Doppler Radar (EDOP), Cloud Radar System (CRS), the Cloud Physics Lidar (CPL), Conical Scanning Millimeter-wave Imaging Radiometer (CoSMIR), and others that have provided advances in cloud and precipitation remote sensing. The aircraft program also provides an avenue to test and fly instruments that can later be extended for observations from space. It is then logical to assume that as science advances, and higher data rates are desired for observations from space, this translates into the need for higher data rate communications from aircraft. The NASA aircraft platforms vary in the altitudes they can achieve, hence different communication needs are likely to exist. This study will look into trades including: available TDRSS services, required coverage, required data rates, communication links, communication frequency comparison (S vs. Ku vs. Ka-bands), and spectrum requirements. The end goal is to make a recommendation for the on-board communications system architecture to communicate airborne science data through TDRSS. This architecture would include recommendations on information data frames and packet formats to meet the existing infrastructure, modulation selection, number of instruments that can communicate through this architecture, and comm. subsystem hardware, including the antenna needed to meet the required links for tracking TDRSS. As part of this study, we would evaluate if one solution could exist that would be feasible for all NASA aircraft platforms. In addition, we would investigate the use of TDRSS in the Long Duration Balloon Program, which currently uses S-band TDRSS Services, and developments done for communications of sounding rockets. In the future, the process and savings outlined by achieving a NASA TDRSS Service for other platforms could be presented to the Global Hawk Operation offices for primary or secondary (backup) communications.

Anticipated Benefits

Reduced cost for airborne telecommunication services

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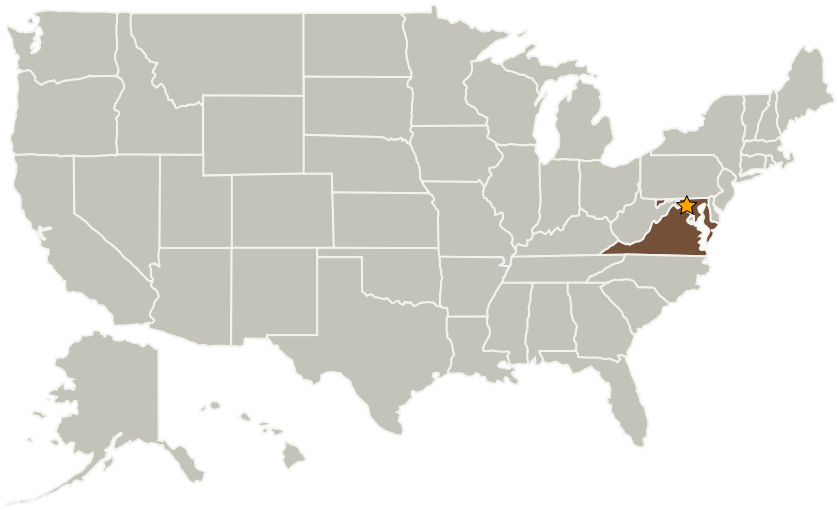
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	Virginia

Links

NTR 1438021089
(no url provided)

Project Website:

http://sciences.gsfc.nasa.gov/sed/

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

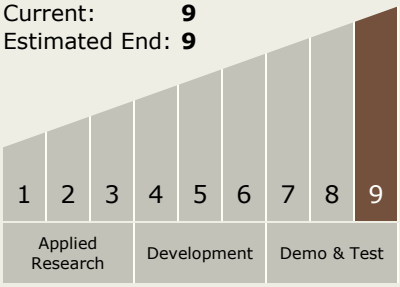
Matthew J Mcgill

Principal Investigator:

Martin L Perrine

Technology Maturity (TRL)

Start: **9**
Current: **9**
Estimated End: **9**



Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.2 Radio Frequency
    - TX05.2.4 Flight and Ground Systems